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Charron et al.

[11] **3,872,847**

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[54] **TEMPERATURE SUPPLEMENTAL PULLDOWN MECHANISM FOR CARBURETOR AUTOMATIC CHOKE**

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[73] Assignee: **Ford Motor Company,** Dearborn, Mich.

[22] Filed: **Aug. 6, 1973**

[21] Appl. No.: **385,509**

[52] **U.S. Cl.** ..... **123/119 F,** 261/39 B

[51] **Int. Cl.** **F02m 1/10**

[58] **Field of Search** ..... 123/119 F; 261/39 B

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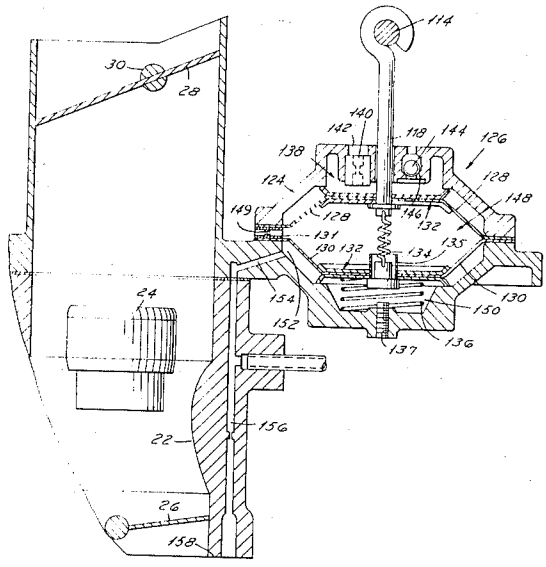
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Assistant Examiner—Sheldon Richter
Attorney, Agent, or Firm—Robert E. McCollum; Keith L. Zerschling

[57] **ABSTRACT**

The carburetor has a conventional automatic choke construction heating a bimetallic coil by engine exhaust stove heat to permit the slow opening of the choke valve during cold weather starts; a supplemental temperature responsive power means at times overrides the bimetallic coil closing force to open the choke to various settings as a function of ambient temperature changes; and includes time delay means to provide a gradual actuation of the valve.

5 Claims, 7 Drawing Figures



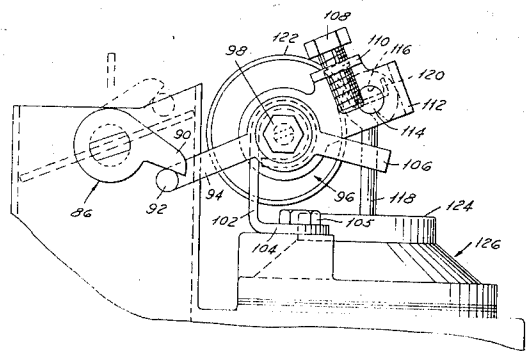


FIG. 1

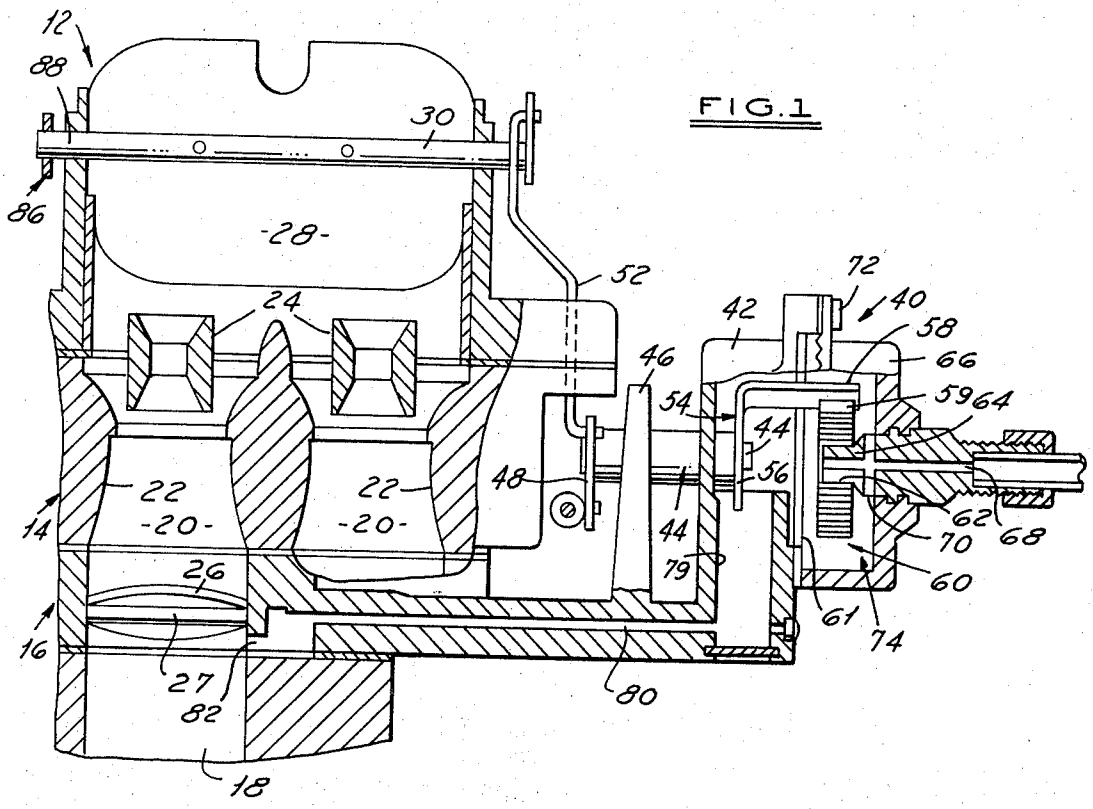

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FIG. 2

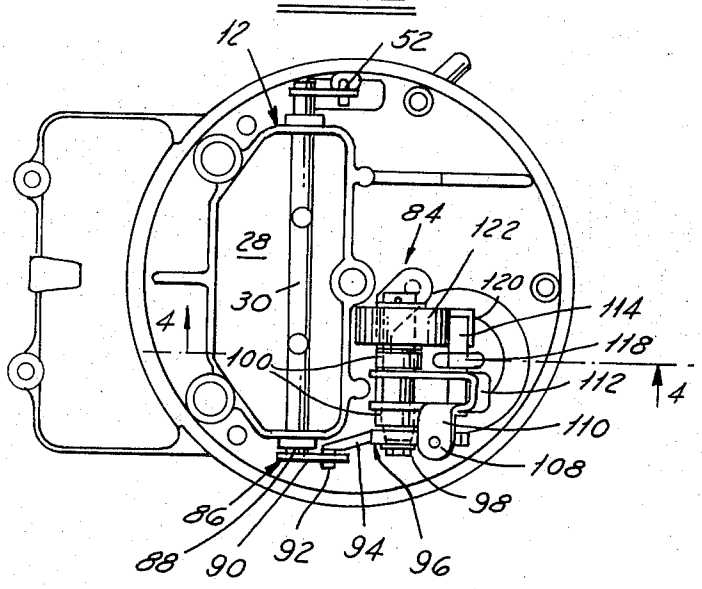

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FIG. 3

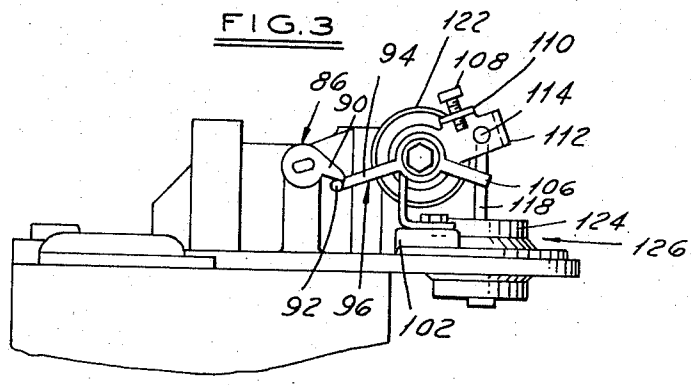

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FIG. 4

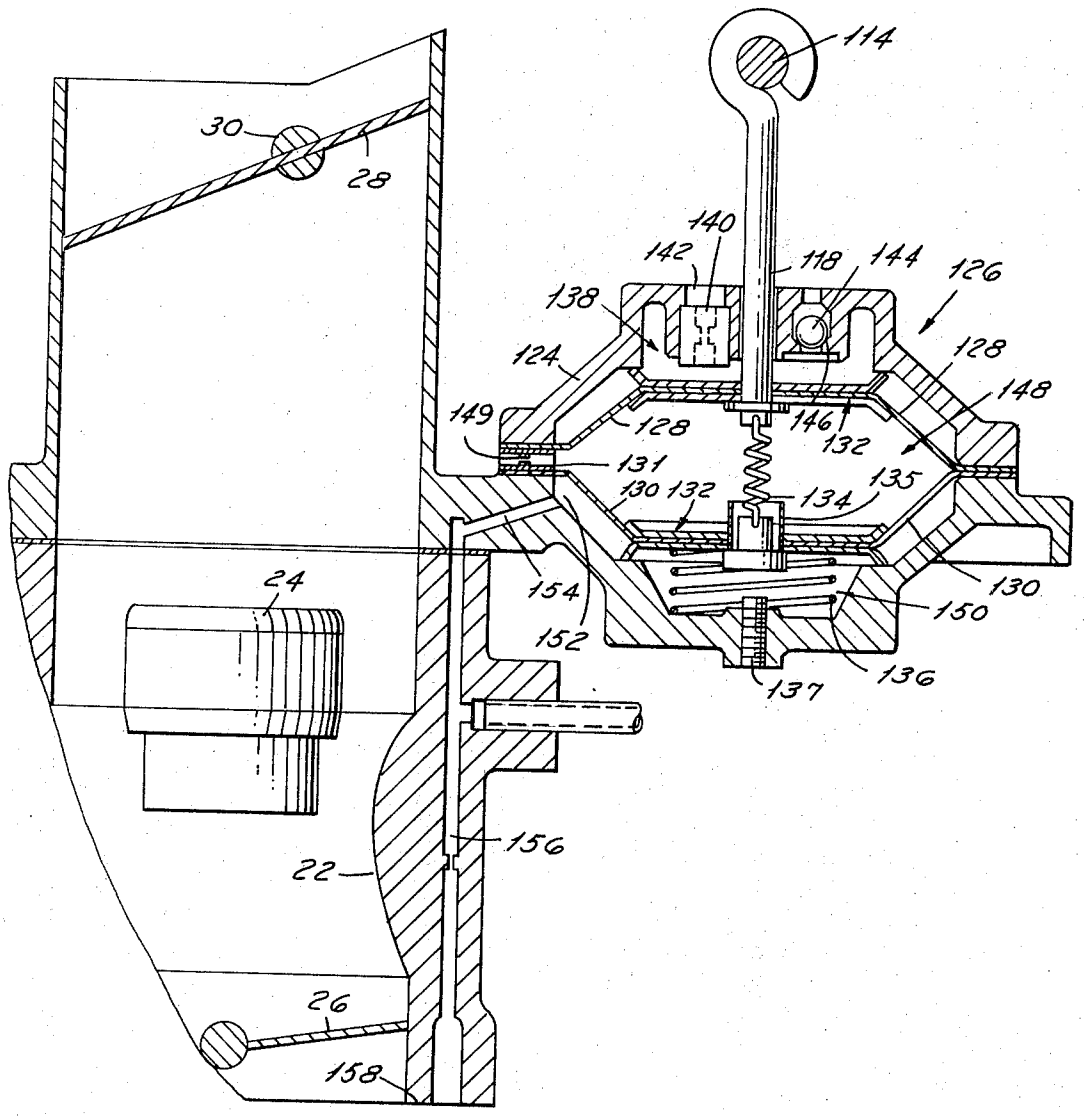

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FIG. 5

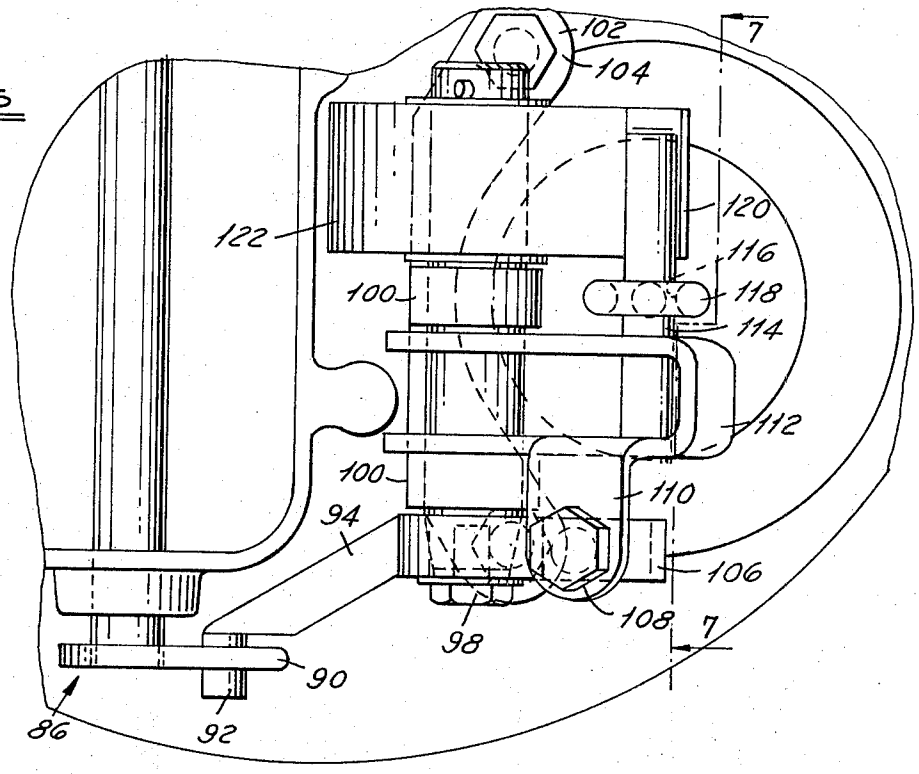

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FIG. 6

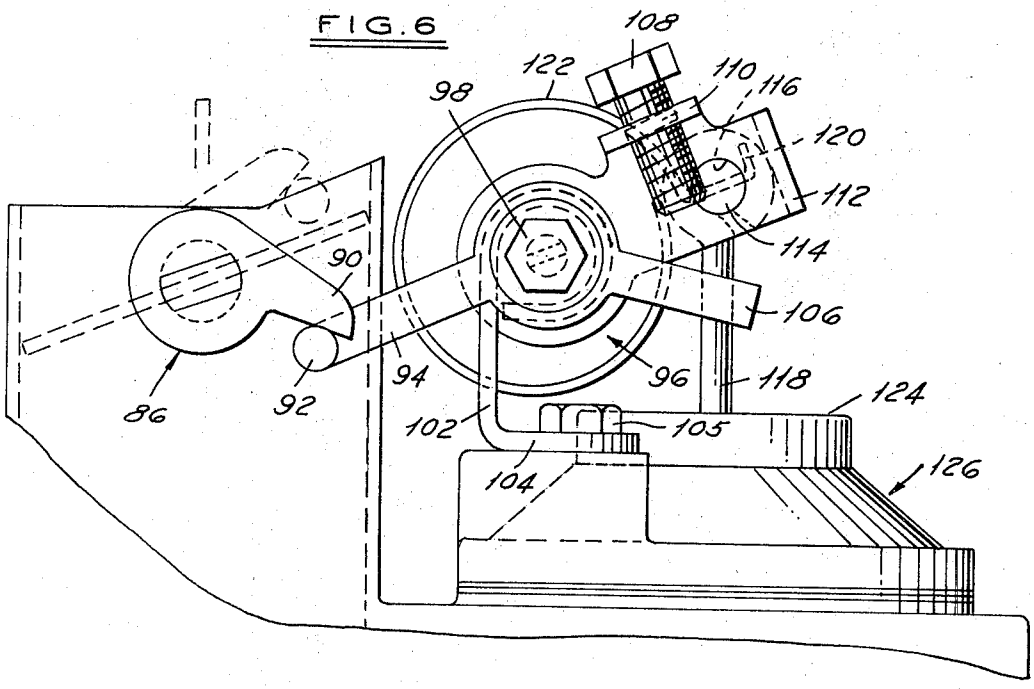
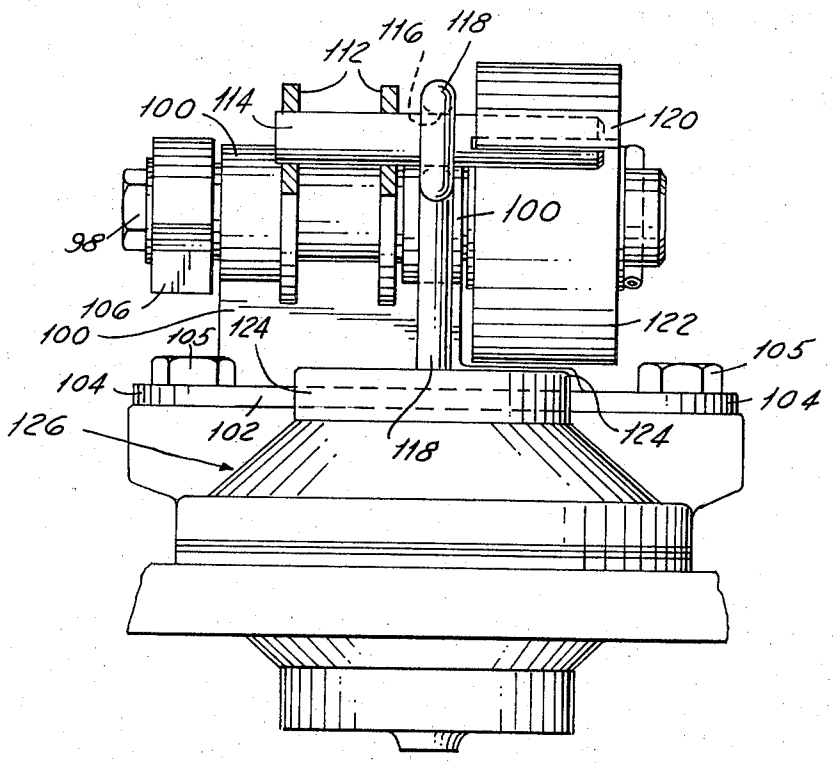

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FIG. 7


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TEMPERATURE SUPPLEMENTAL PULLDOWN MECHANISM FOR CARBURETOR AUTOMATIC CHOKE

This invention relates, in general, to a carburetor for a motor vehicle engine. More particularly, it relates to an automatic choke to provide cold weather starts of an engine, while at the same time minimizing the output of undesirable emissions.

As ambient temperature drops, friction within the engine and the viscosity of the lubricants increase significantly. Therefore, at low temperatures, the speeds at which an engine normally would idle must be increased to prevent stalling. Accordingly, a choke mechanism is provided to richen the fuel/air mixture supplied to the engine during cold starting and engine warm-up.

Generally, the choke apparatus includes a coiled thermostatic spring that operatively rotates the choke valve towards a closed or nearly shut position with decreasing temperatures, and permits the progressive opening of it as the temperature returns towards a chosen level. A manifold suction responsive device generally overrides the coil spring force and cracks open the choke a predetermined angle of say 20°, for example, when the engine starts, to provide a leaner running mixture. The choke action provides a richer than normal mixture so that sufficient fuel can be vaporized to permit smooth starting and running of the engine during cold weather.

The above construction has the disadvantage of having a fixed pulldown regardless of the ambient temperatures. That is, the vacuum servo usually operates against a stop so that as soon as engine operating vacuum is obtained, the choke valve is opened to a fixed angular position of say, in this case, 20°. If the outside ambient temperature is say 50°F., the best mixture for cold running conditions may be obtained if the choke valve were opened only to an angle of, say 10 or 15°. That is, at 20°, the mixture may be too lean, and the engine might stall after starting.

This invention is directed to a choke construction wherein the choke pulldown rate is modified in response to ambient temperature conditions so that the changeover from engine cranking to cold weather running air/fuel mixture richness more accurately reflects actual operating conditions, and thereby reduces the output of emissions of unburned hydrocarbons and carbon monoxides due to nonburning of too rich or too lean a mixture.

It is an object of this invention, therefore, to provide an automatic choke construction that will provide good cold weather starting characteristics and yet reduce to a minimum the output of undesirable smog producing elements.

It is another object of the invention to provide an automatic choke construction that modifies the pulldown rate of the choke as a function of ambient temperature conditions to more accurately determine the cold weather operating air/fuel mixture richness.

It is also an object of the invention to provide an automatic choke construction including an ambient temperature responsive, delayed action pulldown servo operable to open the choke valve by modifying the action of an engine temperature responsive coil spring attempting to shut the choke valve.

Another object of the invention is to provide an automatic choke construction including a first thermostatically controlled bimetal coil spring normally urging the choke valve closed with decreasing engine environmental temperature changes, and opposed by a manifold suction operated motor device that initially cracks open the choke valve in a slow manner to a setting determined as a function of an ambient temperature bimetal coil spring to permit running operation during cold weather, engine exhaust manifold heated air being directed to the first coil spring to warm it, the suction operated device including a flow restriction to delay actuation, and a one-way check valve that allows quick resetting of the device.

Other objects, features and advantages of the invention will become more apparent upon reference to the succeeding detailed description thereof, and to the drawings illustrating a preferred embodiment thereof; wherein

FIG. **1** is a cross-sectional elevational view of a portion of a two-barrel carburetor showing a conventional choke construction;

FIG. **2** is a reduced size top plan view of a carburetor embodying the invention;

FIG. **3** is a side elevational view of a portion of FIG. **2**;

FIG. **4** is an enlarged cross-sectional view taken on a plane indicated by and viewed in the direction of the arrows **4—4** of FIG. **2**;

FIG. **5** is an enlarged view of a portion of FIG. **2**; and,

FIGS. **6** and **7** are enlarged end and side views of FIG. **2**.

FIG. **1** is obtained by passing a plane through approximately one-half of a known type of two-barrel, downdraft type carburetor. The portion of the carburetor shown includes an upper air horn section **12**, an intermediate main body portion **14**, and a throttle valve flange section **16**. The three carburetor sections are secured together by suitable means, not shown, over an intake manifold indicated partially at **18** leading to the engine combustion chambers.

Main body portion **14** contains the usual air-fuel mixture induction passages **20** having fresh air intakes at the air horn ends, and connected to manifold **18** at the opposite ends. Each of the passages is formed with a main venturi section **22** containing a booster venturi **24** suitably mounted for cooperation therewith, by means not shown.

Flow of fuel and air through each passage **20** is controlled by a conventional throttle valve **26** fixed to a shaft **27** rotatably mounted in flange portion **16**. The throttle valves are rotated in a known manner by depression of the vehicle accelerator pedal, and move from an idle speed position essentially blocking flow through passage **20** to a wide open position essentially at right angles to the position shown.

Airflow through passages **20** is controlled in part by a choke valve **28** unbalance mounted on a shaft **30** rotatably mounted on side portions of the carburetor air horn, as shown. The rotative position of choke valve **28** is controlled in part by a semiautomatically operating choke mechanism **40**. The latter includes a hollow housing portion **42** that is formed as an extension of the carburetor throttle flange. The housing is apertured for supporting rotatably one end of a choke lever operating shaft **44**, the opposite end being rotatably supported in a casting **46**. A bracket or lever portion **48** is fixed on the left end portion of shaft **44** for mounting the end of a rod **52** that is pivoted to choke valve shaft **30**. It will be clear that rotation of shaft **44** in either direction will

correspondingly rotate choke valve **28** to open or close the carburetor air intake, as the case may be.

An essentially L-shaped thermostatic spring lever **54** has one leg **56** fixedly secured to the opposite or right-hand end portion of shaft **44.** The other leg portion **58** of the lever is secured to the outer end **59** of a coiled bimetallic temperature responsive spring element **60** through an arcuate slot, not shown, in an insulating gasket **61.** The opposite inner end portion **62** of the spring is fixedly secured on the end of a nipple **64** that is formed as an integral portion of a choke cap **66** of heat insulating material. Nipple **64** is bored as shown to provide hot air passages **68** and **70,** passage **68** being connected to a conventional exhaust manifold heat stove, for example. Cap **66** is secured to housing **42** by suitable means, such as the screw **72** shown, and defines an air or fluid chamber **74** within the two.

As thus far described, it will be clear that the thermostatic spring element **60** will contract or expand as a function of the changes in engine operating temperature conditions of the air entering tube **68,** or, if there is no flow, the temperature of the air within chamber **74.** Accordingly, changes in engine operating temperature will rotate the spring lever **54** to rotate shaft **44** and choke valve **28** in one or the other directions, as the case may be.

Housing **42** contains a bore **79** that is acted upon by vacuum in a passage **80.** The passage is connected to the carburetor main induction passages **20** by a port **82** that is located just slightly below throttle valve **26.** Chamber **74,** therefore, is always subject to the vacuum existing in the intake manifold passage portion **18,** to effect flow of the heated air essentially at atmospheric pressure through tube **68** into chamber **74.**

As is known, a cold weather start of a motor vehicle requires a richer mixture than a warm engine start because considerably less fuel is vaporized. Therefore, the choke valve is shut or nearly shut to increase the pressure drop thereacross and draw in more fuel and less air. Once the engine does start, however, then the choke valve should be opened slightly to lean the mixture to prevent engine flooding or stalling as a result of an excess of fuel.

The choke mechanism shown on the right side in FIG. **1,** supplemented by the choke mechanism **84** in FIG. **2,** automatically accomplishes the above action. More specifically, in FIG. **2,** a control lever **86** is fixed on the left end **88** of choke shaft **30,** and has a finger portion **90.** The finger portion is adapted to abut and be moved at times by the out-turned pin end **92** of one leg **94** of a bellcrank lever **96.** The lever **96** is fixed on the end of a shaft **98** which is rotatably supported in a pair of bushings **100** extending from a supporting bracket **102** shown in FIG. **3.** The bracket has a L-shape, with ears **104** secured by bolts **105** to the top of the carburetor air horn surface, as best seen in FIG. **6.**

The bellcrank **96** has a second leg **106** that is adapted to be engaged by the end of a screw **108.** The screw is adjustably mounted in a finger-like or tab extension **110** of a yoke shaped member **112** loosely mounted on shaft **98.** A pin **114** is anchored at one end in aligned holes in member **112,** and projects through the eye **116** of a pulldown lever or rod **118.** The other end of pin **114** is slotted for receiving the outer upturned end **120** of a bimetallic coil spring **122.** The spring is wound around shaft **98** and keyed at its inner end to the shaft. The coil spring **122** in this case is responsive to ambient temperature changes of the air surrounding the air horn section of the carburetor to coil or uncoil the spring. The rod **118** moves down when vacuum is applied causing pin **114,** member **112,** tab **110** and screw **108** to contact and move leg **106,** rotate shaft **98,** leg **94** so that pin end **92** contacts finger portion **90** and rotates shaft **88** opening the choke valve plate **28.** This provides minimum choke plate opening at extremely cold temperatures. Conversely, pin **114** contacts bimetal end **120** rotating bimetal **122** and shaft **98** so that leg **94** actuates lever **86** to rotate shaft **88** and open choke plate **28** a greater amount due to high bimetal environment temperatures. In this case, the spring **122** has rotated leg **106** away from screw **108** so that the pulldown by rod **118** has less effect on opening the valve.

In FIG. **4** the pulldown rod **118** projects sealingly through the housing **124** of a vacuum sensitive servo or motor device **126.** The servo contains a pair of spaced annular flexible diaphragms **128** and **130** edge mounted in the housing walls. An annular retainer assembly **132** is riveted to each of the diaphragms, and are interconnected by an extension spring **134.** The retainer assembly for diaphragm **128** also is fixed to pulldown lever **118.** The lower diaphragm **130** is biased upwardly by a compression spring **136.**

The upper chamber **138** defined between the housing and diaphragm **128** communicates with the atmosphere either slowly through an orificed flow time delay device **140** in a port **142,** or rapidly past a ball check valve **144** engagable with a seat **146.** The central chamber **148** defined between the diaphragms is connected to atmosphere by an orifice **149,** and controls the movement of diaphragm **128,** in a manner to be described. The lower chamber **150** between diaphragm **130** and the housing is connected to engine manifold vacuum through a side port **152.** The port is connected by cast passages **154** and **156** to a carburetor port **158.** Port **158** opens into the induction passage **20** at a point below the closed position of the throttle valve, like port **82.**

On cold weather starts, the temperature of the air in chamber **74** will be low so that spring element **60** will contract and urge shaft **44** and choke valve **28** to an essentially closed position, as desired. Initially, screw **108** will be adjusted to rotate shaft **98** counterclockwise to separate lever **96** from finger **110** to provide the desired initial spring preload opposing movement of link **118** by a predetermined unwinding of the spring **122.** During cranking of the engine, therefore, manifold vacuum in servo passage **154** will not be sufficient to move the lower diaphragm **130** against the force of coil spring **60** to open the choke valve. Spring **134** may slightly extend. Accordingly, the engine will be started with a rich mixture. As soon as the engine is running, however, high vacuum in servo passage **154** acting on diaphragm **130** will move it downwardly. The preload force of ambient temperature responsive spring **122** will be chosen so that at the lowest ambient temperature setting, say -20°F, for example, the engine running vacuum force on diaphragm **130** will be sufficient to overcome the forces of both coil springs **122** and **60** and springs **134** and **136** to pull open the choke valve **28** a slight amount, say to an angle of 6°, for example. That is, as shown in FIG. **6,** the vacuum on diaphragm **130** will first move the diaphragm downwardly, extending spring **134** without moving diaphragm **128.** Diaphragm **128** and lever **118** then will move downwardly slowly from the position shown as a function of the rate

of passage of air in chamber **148** through the orifice **149.** This will rotate finger **110** and screw **108** against bellcrank leg **106.** The opposite leg **94** will then pivot lever **86** and choke valve **28** open the 6°. The extension of spring **134** permits the diaphragm **128** to have a controlled slow downward movement as a function of the orifices **140** and **149.**

If the engine temperature warms faster than ambient, the lessening closing force exerted by the coil spring **60** will permit movement of the choke valve to a greater opening by airflow against the choke valve. In this case, lever **86** will rotate counterclockwise away from the pin end **92** of lever **96.** On the other hand, engine starts with cold engines and with warmer than the coldest setting ambient temperatures, the relative movement of spring **122** between the pin **114** and the slot in shaft **98** will rotate shaft **98** and cause lever **96** to rotate clockwise thereby rotating lever **86** counterclockwise, thus opening choke plate **28** a greater amount as a function of ambient temperature increases (20°, for example) then would normally be the case by the pulldown servo **126** alone. The rate of pulldown, therefore, will always be modified in accordance with ambient temperature changes to permit a greater or less choke valve opening as the ambient temperature changes.

While the invention has been shown and described in its preferred embodiment, it will be clear to those skilled in the arts to which it pertains, that many changes and modifications may be made thereto without departing from the scope of the invention.

We claim:

1. An automatic choke system for use with a carburetor having an air/fuel induction passage and

an unbalance mounted, air movable, choke valve mounted for variable movement across the passage to control airflow through the passage,

first engine temperature responsive spring means operably connected to the choke valve urging the choke valve towards a closed position with a force increasing as a function of decreases in the temperature of the spring means from a first predetermined level,

a choke pulldown servo sensitive to engine manifold vacuum for operatively moving the choke valve towards an open position in opposition to the spring means, and

second ambient temperature responsive bimetal coil spring means between the servo and choke valve for controlling the opening of the choke valve as a function of ambient temperature changes from a second predetermined level, the ambient responsive spring having an inner end secured to a shaft and an outer end movable circumferentially in response to the coiling and uncoiling of the ambient spring in response to ambient temperature changes, means connecting the outer end of the ambient spring to the pulldown servo, and a lever fixed to the shaft, the lever having first and second legs extending in opposite directions, one leg extending in a direction to be engaged at times and moved by abutment means on the servo upon operation of the servo, the second leg being movable in a path containing the choke valve and moving alternately in response either to movement of the lever by the abutment means or in response to ambient temperature changes effecting rotation of the shaft to operatively engage the choke valve to move it to an open pulldown position, the degree of pulldown opening of the choke valve varying as a function of the ambient temperature level.

2. An automatic choke system for use with a carburetor having an air/fuel induction passage and

an unbalance mounted, air movable, choke valve mounted for variable movement across the passage to control airflow through the passage,

first temperature responsive spring means operably connected to the choke valve urging the choke valve towards a closed position with a force increasing as a function of decreases in the temperature of the spring means from a first predetermined level,

power means sensitive to engine manifold vacuum for moving the choke valve towards an open position in opposition to the spring means, and

second temperature responsive means connected to the power means for controlling the movement of the power means as a function of the temperature changes from a second predetermined level, the power means comprising a vacuum servo consisting of first and second flexible annular diaphragms, lever means having an operable connection to the choke valve and to the first diaphragm, first extendable spring means yieldably connecting the diaphragms, second spring means biasing the second diaphragm towards the first diaphragm in a choke valve closing direction, manifold vacuum means acting at times on the second diaphragm in opposition to the first and second spring means for moving the second diaphragm in a choke valve opening direction, the second temperature responsive means being connected to the lever means for controlling movement of the lever means and thereby the first and second diaphragms to control the opening movement of the choke valve as a function of the temperature changes of the second temperature responsive means.

3. A choke system as in claim **1,** including intermittently operating time delay means operably connected to the power means for effecting at times a slow movement of the choke valve by the power means.

4. A choke system as in claim **1,** the operable connection between the lever means and choke valve comprising a one-way overrun connection permitting opening of the choke valve by airflow thereagainst as a function of the temperature of the first temperature responsive means regardless of the temperature of the second temperature responsive means.

5. A choke system as in claim **1,** including delay means associated with the diaphragms controlling the rapidity of movement of the diaphragms in a choke valve opening direction to provide a controlled rate of opening.

* * * * *